



THE USE OF AI IN PERSONALIZED DEPRESSION CARE

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ABSTRACT

The depression rate has been ever-increasing in the past decade, and there are more than 10 types of antidepressants available. Currently, many doctors and healthcare workers have been attempting to find the best type of antidepressants for their patients with their multiple trials, but this has led to an increase in suicidal rates every year. Interestingly, artificial intelligence has been shown to analyze patient's genetics, facilitate remote monitoring, track their medication records with its accurate algorithms, and process mass datasets quickly. Thus, this paper aims to provide a structured analysis of the extent to which AI can be included in the healthcare industry to optimize personalized medication for depression patients in order to balance out undesirable side effects.

KEYWORDS: Artificial Intelligence (AI), Personalized Medicine, Depression Care, Genetic Data Analysis, Medication Optimization, Healthcare Innovation

INTRODUCTION

In a world where artificial intelligence (AI) can help humans generate information quickly, process data accurately, and solve complex problems, it has emerged in many industries to help with problem-solving and developing revolutionary products. On top of that, AI has also been used in the healthcare industry to speed up the process of analyzing datasets and timely interventions (Roy, 2023). Depression has become more common as society becomes more competitive; according to the World Health Organization (WHO), there are approximately 280 million people around the world who are suffering from depression. Patients with depression are constantly required to switch medications to find the one that best suits them; however, this often comes with numerous side effects, leading to suicides and worsening the patient's mental health. What if AI can help with personalizing medications and treatments? Considering that up to 13% of the depressed population every year take their own lives due to the side effects of depression (Pompili et al., 2010), AI technology allows patients with depression to be prescribed personalized medications by analyzing their genetics, monitoring them remotely while making changes to medication dosage accordingly, and tracking their past medication history in order to minimize the risk of worsening one's depression.

Research Question

To what extent can AI contribute to the development of personalized medicine, specifically for patients with depression?

LITERATURE REVIEW

The recent advancement of artificial intelligence technology has gained considerable attention globally, and numerous studies have been conducted that emphasize the effectiveness and accuracy of AI tools. In May 2024, Oxford University researchers invited depression patients to participate in their clinical

research on how AI can treat individuals differently according to their needs, symptoms, genetics, and past medication history. This enhances the treatment outcomes and patients' well-being. On the other hand, investigations have shown an increase in the risk of suicidal behavior after taking anti-depressants (CNS Neuroscience & Therapeutics, 2010). For instance, a man was treated with a type of antidepressant and was then told to switch shortly after. The rapid change in medication was shown to contribute to his suicidal attempts and behaviors (CNS Neuroscience & Therapeutics, 2010). This case continues to add to the importance of AI-personalized prescriptions. One limitation of AI medication is the cost; implementing a well-developed AI medication bot for individuals is quite expensive, and it might become a barrier to those struggling with finances. However, the governments can work to fund an AI bot for those who are concerned with the budget but are hoping to receive personalized medication. Ultimately, AI is a useful tool to assist doctors in avoiding severe side effects and, most importantly, lower the risk of suicide.

METHODOLOGY

This paper adopts a secondary qualitative methodology to investigate the role of artificial intelligence (AI) in optimizing personalized depression care. The research relies on an extensive review of existing literature, case studies, and reports to explore AI's capabilities in analyzing genetic data, monitoring patient symptoms, and tailoring medication regimens. This approach enables a comprehensive understanding of AI's potential to enhance depression treatment without the need for primary data collection.

The methodology is well-suited for synthesizing insights across diverse sources, facilitating an in-depth exploration of how AI reduces trial-and-error prescriptions and minimizes side effects. However, the reliance on secondary data introduces limitations,

such as potential biases in the sources and a lack of real-time or patient-specific findings. Despite these constraints, the chosen methodology effectively highlights AI's transformative role in personalized medicine, providing a foundation for future experimental studies.

RESULTS & DISCUSSION

How Can It Help?

With AI being considerably advanced and accurate, it can help with analyzing one's genetics to avoid prescribing the wrong medication. Antidepressants are one of the most frequently used medications for those with depression, but they come with numerous side effects such as nausea, dizziness, and sleepless nights. Nowadays, doctors often rely on the trial-and-error process to find the best medication that suits the patients and sometimes make mistakes. The process of finding an appropriate medication is often torturing and painful, pushing those who are already in pain to take their own lives. For instance, recently in New Zealand, a young lady with depression was given the wrong medication and had a severe allergic reaction to it, leaving her feeling "burned from the inside" (English, 2024). This case highlights the errors that come with humans prescribing antidepressants or other medications, and thus, AI can help with analyzing one's data and suggesting the medicine that best suits one. It is capable of identifying patterns and records that may identify patients' conditions or symptoms and "analyzing medical images such as CT and MRI scans or X-rays to detect anomalies" (Monash University, 2023). AI can therefore propose a few promising and appropriate medication options for doctors to prescribe, reducing the time and side effects of transitioning depression medications. There has been a trial conducted at the University of Oxford, England, where patients with depression use "Petrushka," an AI algorithm, to tailor-make their very own medication plan and to choose the antidepressant that best fits them. Professor Andrea Cipriani emphasizes that AI can personalize treatments and be as precise as currently possible since they could better observe data (University of Oxford, 2024). In the near future, doctors will be able to get a list of medication suggestions by simply putting in the patient's data, and AI will analyze the dataset and identify patterns, aiming to lower the side effects and the risk of worsening one's depression.

Whilst it typically takes up to 8 weeks for patients' signs of depression to improve after taking antidepressants, most patients can feel a change in their bodies as well as side effects just after a couple of days, and AI can help with remote patient monitoring, allowing patients to receive medications based on their real-time and up-to-date symptoms (Smedley, 2022). Hence, patients will not need to visit the doctor to receive updated prescriptions and concise medical advice. AI technology can generate predictive analytics with the input of the patient's data while notifying the doctors and gathering data from the patient's genetics, as previously mentioned. For instance, AI has helped a patient with heart failure to prevent heart failure exacerbation as it found inconsistent patterns in their heart rate, alerting the patient in time to adjust their medication (Murphy, 2024). This case has proven AI's alertness and higher pace of processing information than doctors. Doctors can train the

AI programs to give medical advice based on their updated symptoms and signs of depression, allowing more accurate doses of depression medication while balancing the outcomes. Thus, AI can soon take up the role of advising and monitoring patients while they are on their depression medication and enables the customization of medication dosages to avoid intensifying one's depression symptoms and side effects.

Lastly, doctors can utilize AI tools and algorithms to track the patient's past medication history as patients to avoid prescribing the same type of medication that the patient has received before, enhancing the patient's safety and preventing the switch of medication and side effects. AI's algorithm can interpret and analyze a patient's medication history in a short amount of time. According to PsychCentral, a website that specializes in discussing about the different kinds of mental health medications, that if one rapidly switches between various types of antidepressants, the patient will likely be experiencing the side effects of both new and old medication, such as loss of appetite, heartburn, and headaches, worsening their physical feelings, and often leading to suicides. Additionally, patients who have been constantly switching antidepressants over a long period of time are likely to develop "antidepressant tolerance," lowering the effectiveness of other types of medication on the patient (Elmer, 2022). In 2008, a man with depression was first prescribed imipramine and then switched to escitalopram; the side effects that came with the switch of medication tortured him, ultimately worsening his depression, and he admitted that he had suicidal thoughts (Reeves & Ladner, 2010). AI's algorithm can help with tracking the patient's past medication history to avoid the change of drugs, as it can quickly interpret and analyze what medication is best suited for the patient. This can be done to evade the switch of medication and exacerbate their depressed emotions. AI enables doctors to be notified of the types of antidepressants that the patient has been prescribed by analyzing their medical records, speeding up the process for the doctors while trying to find a suitable medication for them.

Rebuttal

While many might argue that AI provides a negative diagnosis, there have been cases that have proven that AI is more accurate than doctors, as it can better analyze an image and people's genes and then generate suggestions. For example, recently in England, there was a patient who noticed lumps in her breast, but the 11 doctors have claimed that she was cancer-free. However, AI noticed a very tiny 6 mm tumor in her breast, and she ended up only needing 5 days of radiotherapy (Kleinman, 2024). Moreover, many people oppose AI due to its incomplete data sets and doubt its ability to make accurate medical decisions. The Amsterdam University Research Center has proven that AI can help predict the patient's antidepressant response, as it is can predict the efficiency of the medication to specific patients to prevent the switch of medications, thereby minimizing the risk of suicides (News Medical, n.d.). To conclude, AI has the ability to help with personalizing medication while keeping its data accurate and precise, as a means to optimize drug efficacy and balance the side effects to lower the risk of suicidal behaviors.

CONCLUSION

By evaluating and analyzing one's genetics, monitoring them remotely, and adjusting the dosage of medication, if necessary, as well as tracking their past medication history, AI enables a personalized medication approach for depression patients, reducing the risk of suicide and undesirable side effects. With AI's ability to process mass datasets quickly, it can offer constructive insights into the genetics, clinical, and lifestyle factors and aims to generate a list of drug suggestions for doctors. Incorporating artificial intelligence into the healthcare industry can help patients with depression find their best-suited medicine without having to endure side effects. The integration of AI technology enhances efficiency and advances data analysis, allowing depression patients to receive the best care that they need according to their conditions.

REFERENCES

1. Elmer, J. (2022, January 19). What to Expect When Switching Antidepressants. PsychCentral. <https://psychcentral.com/health/switching-antidepressants>
2. English. (2024, May 8). NDTV. NDTV.com. <https://www.ndtv.com/feature/new-zealand-woman-burned-from-the-inside-after-severe-reaction-from-depression-medication-5614905>
3. Kleinman, Z. (2024, March 21). NHS AI test spots tiny cancers missed by doctors. BBC News. <https://www.bbc.com/news/technology-68607059>
4. Monash University. (2023, January 13). AI in healthcare: Career scope in Australia. Monash Online. <https://online.monash.edu/news/ai-in-healthcare/>
5. Murphy, J. (2024, August 23). How is AI Used in Remote Patient Monitoring? Tenovi. <https://www.tenovi.com/ai-in-remote-patient-monitoring/>
6. Pompili, M., Serafini, G., Innamorati, M., Ambrosi, E., Giordano, G., Girardi, P., Tatarelli, R., & Lester, D. (2010). Antidepressants and Suicide Risk: A Comprehensive Overview. *Pharmaceuticals*, 3(9), 2861–2883. <https://doi.org/10.3390/ph3092861>
7. Reeves, R. R., & Ladner, M. E. (2010). Antidepressant-Induced Suicidality: An Update. *CNS Neuroscience & Therapeutics*, 16(4), no-no. <https://doi.org/10.1111/j.1755-5949.2010.00160.x>
8. Roy, A. (2023, July 28). Artificial intelligence: 10 promising interventions for healthcare. NIHR Evidence. <https://evidence.nihr.ac.uk/collection/artificial-intelligence-10-promising-interventions-for-healthcare/>
9. Smedley, T. (2022, August 10). How Long Does It Take for Antidepressants to Start Working? GoodRx. <https://www.goodrx.com/conditions/depression/time-for-antidepressants-to-work>
10. (13 C.E., May). AI to help personalise treatment for depression as part of major trial Department of Psychiatry, Medical Sciences Division; Oxford University. <https://www.psych.ox.ac.uk/news/ai-to-help-personalise-treatment-for-depression-in-oxfordshire-as-part-of-major-trial>